1163-13-119 **Scott T. Chapman*** (scott.chapman@shsu.edu), Department of Mathematics and Statistics, Box 2206, Huntsville, TX 77341, and **Christopher O'Neill** and **Vadim Ponomarenko**. *On Length Densities.*

For a commutative cancellative monoid M, we introduce the notion of the *length density* of both a nonunit $x \in M$, denoted $\mathrm{LD}(x)$, and the entire monoid M, denoted $\mathrm{LD}(M)$. This invariant is related to three widely studied invariants in the theory of non-unit factorizations, $L(x)$, $\ell(x)$, and $\rho(x)$. We consider some general properties of $\mathrm{LD}(x)$ and $\mathrm{LD}(M)$ and give a wide variety of examples using numerical semigroups, Puiseux monoids, and Krull monoids. While we give an example of a monoid M with irrational length density, we show that if M is finitely generated, then $\mathrm{LD}(M)$ is rational and there is a nonunit element $x \in M$ with $\mathrm{LD}(M) = \mathrm{LD}(x)$ (such a monoid is said to have accepted length density). While it is well-known that the much studied asymptotic versions of $L(x)$, $\ell(x)$ and $\rho(x)$ (denoted $\overline{L}(x)$, $\overline{\ell}(x)$, and $\overline{\rho}(x)$) always exist, we show the somewhat surprising result that $\overline{\mathrm{LD}}(x) = \lim_{n\to\infty} \mathrm{LD}(x^n)$ may not exist. We also give some finiteness conditions on M that force the existence of $\overline{\mathrm{LD}}(x)$. (Received August 17, 2020)